Faster! Faster!

How to Beat the Bandwidth Blues

You want your bandwidth, and you want it now. Your 28.8 Kbps modem has been performing with all the vigor of The Little Engine That Could, but you're still not getting transfer rates acceptable for multi-megabyte downloads. Fear not, intrepid cybernaut, for a variety of technologies can help you beat the bandwidth blues. Some exist in real-space, while others are still vaporware waiting to condense. Read on as we investigate ways to raise your Internet speed limit.

by Kevin Savetz

33.6 Kbps Modems

Speed: 28 Kbps–33.6 Kbps
Cost: free (with a software upgrade)–$250
Availability: excellent

The least-expensive option for breaking the 28.8 Kbps barrier is a 33.6 Kbps modem, which can, in theory, send and receive data 16 percent faster than its slower cousin.

How It Works

A 33.6 Kbps modem works almost exactly like a 28.8 Kbps modem: It converts digital data to an analog signal for transmission across a phone line. On the receiving end, another modem translates the analog signal back to digital bits; 33.6 Kbps modems simply use a slightly faster transmission protocol to get the job done.

Unlike most of the other technologies listed in this article, a 33.6 Kbps modem will work with the same phone cords, wall jacks, and underground copper wires that slower modems use. This means you can use the same phone line you're already using for telephone calls.

Caveats

In reality, the 16 percent speed increase from 28.8 Kbps to 33.6 Kbps is negligible. Although this speed boost is better than a sharp stick in the eye, it doesn't feel that much faster than 28.8 Kbps when you're online. What's more, the jump to 33.6 Kbps isn't commensurate with speed increases that the modem industry has already mustered: The jump from 9600 bits per second modems to 14.4 Kbps modems represented a 50 percent speed increase, and the jump from 14.4 Kbps to 28.8 Kbps represented a 100 percent increase. By comparison, a 16 percent increase seems almost silly.

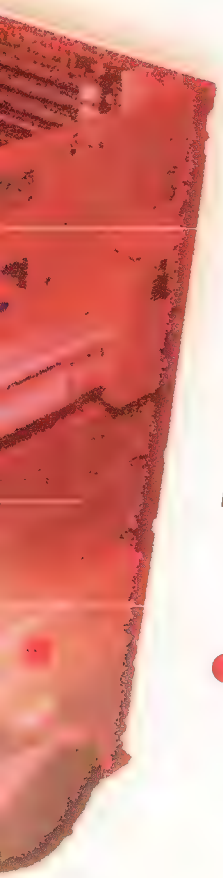
Have you ever noticed that your 28.8 Kbps modem doesn't always connect at top speed, even when connecting to a comparable modem? This may be due to noise on your phone line, and the faster your modem communicates, the less tolerance it has for noise. Your phone line simply may not be able to eke out a reliable 33.6 Kbps connection. Phone conversations disrupted by static, and modem connections plagued by unexpected disconnects suggest noisy lines. A final concern: Modem manufacturers, in their rush to offer the fastest boxes as quickly as possible, have released their 33.6 Kbps modems without any support for a 33.6 Kbps transfer rate standard, which at press time was still being determined. It's therefore possible that modems from different manufacturers may not communicate with each other properly above speeds of 28.8 Kbps. So, if you're buying a new 33.6 Kbps modem, make sure you can upgrade it (preferably through flash ROM) to the new 33.6 Kbps standard once it's approved.

How to Get It

To get cruising at this speed, all you'll need is–surprise!–a 33.6 Kbps modem. Make sure your ISP offers 33.6 Kbps access, and if so, what brand of modem it uses. Ideally, you and your ISP should use the same brand.

How Much It Costs

If you already have a 28.8 Kbps modem, you may be able to upgrade your modem



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to 33.6 Kbps at little or no cost. Just contact your modem's manufacturer to determine if you can download a flash ROM upgrade from its FTP site, or order a replacement chip to do the upgrade yourself. Upgrading with flash ROM is simple: You merely run a special program that updates the modem's internal software. A chip upgrade involves opening your modem's chassis and manually replacing a part. This may sound scary, but actually requires little effort.

If the modem manufacturer says your model really does max out at 28.8 Kbps, it may still give you a discount on a new box. Supra (**http://www.supra.com/**), for example, will replace a 28.8 Kbps modem with a faster one for about $75.

Modems slower than 28.8 Kbps cannot be upgraded to 33.6 Kbps. So, if you're currently moving at 14.4 Kbps, you might as well leapfrog over to 33.6 Kbps. A new 33.6 Kbps modem, such as the U.S. Robotics Sportster (**http://www.usr.com/**), will cost around $250. ISPs generally do not charge extra for 33.6 Kbps access.

ISDN

Speed: 64 Kbps–128 Kbps
Cost: $300–$1000 for hardware, plus $25–$35 for monthly fees
Availability: good

ISDN stands for Integrated Service Digital Network—that's tech-speak for "way fast phone lines." This technology can offer access speeds of up to 128 Kbps. That's 4.5 times the speed of that ever-lagging 28.8 Kbps modem.

How It Works

To surf the Internet via ISDN, you'll need to mothball your old analog modem, and instead go with an "ISDN router." This router works much like a modem, in that it transfers data between your computer and your ISP. However, unlike a typical modem, ISDN sends and receives digital signals, eschewing the lethargic process of analog wave conversion altogether.

ISDN runs over the phone wires already installed at your home or office, but your phone company must first switch these wires for digital service. This requires two operations: extensive testing and "conditioning" of the wires to make sure they can carry a signal that's clear enough for digital data, and installation of special jacks for ISDN compatibility. A single ISDN connection can, with certain hardware configurations, support up to eight different communication devices.

Caveats

ISDN is a very real technology, but it may not be available to you if your telephone company or ISP isn't yet with the program. And even if your phone company does offer access, you won't be able to get ISDN if your particular phone line is located too far away from the phone company's switching equipment. You may also find that you need a new phone and answering machine—analog phones and answering machines won't work with ISDN outlets unless you run them through special adaptors.

If you have the choice, try to buy the same brand of router that your ISP uses. This isn't essential, but if you're both using the same hardware, you may be able to utilize compression features, which pack more data onto the line, providing an effective throughput faster than 128 Kbps. This works well with easily compressed data like text, but does little good with data that is already compressed, like .GIF and .ZIP files. When push comes to shove, using the same hardware may be impossible: Many ISPs have industrial-strength ISDN routers that don't come in consumer versions.

Finally, some people are wary of investing in ISDN, because it may be leapfrogged by faster technologies such as ADSL and cable modems, which are reviewed on page 38. This remains to be seen, but the fact is that ISDN is a reliable, widely available tool, while other technologies are either not ready for prime time, or are too expensive for home consumers and small businesses.

How to Get It

Both ISPs and phone companies are now acting as one-stop ISDN services. If you establish service via an ISP, it will recommend or sell you a router, and help you deal with your telephone company to make sure you have the proper phone connections. You can also go straight to the phone company for similar services, but you may not receive all the Internet support to which you've grown accustomed via your ISP. The bottom line: By hook or by crook, you'll need an ISDN router and digital phone line.

How Much It Costs

ISDN can be expensive, but not prohibitively so. The cost depends on three variables: the price of your ISDN router, your ISP's fee, and your telephone company's fee. A router that can connect a single computer to the Internet will cost from $300 to $500; one that can connect a small LAN will cost about $1000.

Query various ISPs about their ISDN rates, which can range from $25 a month for all-you-can-eat access to $5 an hour for pay-as-you-go access. The industry simply hasn't settled on a common price range for ISDN. You'll need to call your local telephone company about its fees—every telco has its own idea of what ISDN is worth. Pacific Bell charges about $35 per month for a digital phone line, plus a penny a minute when you're connected during business hours.

Bits, Bytes, and Baud: What the Heck Is the Difference?

Bit: The smallest amount of data you're likely to deal with, a bit is basically a binary 0 or 1. Each character you see on your screen needs eight bits in order to be displayed. Modem speeds are typically measured in thousands of bits per second, for example, 28,800 bits per second. Most often, you'll see bits grouped into thousands (kilobits or Kb) or millions (megabits or Mb). You probably have either a 14.4 Kbps (kilobit per second) modem or a 28.8 Kbps modem. Notice the capitalization in "Kb" and "Mb." This will be important when you turn the page.

continued

Byte: One byte equals eight bits. Each character you see on your screen requires one byte in order to be displayed. RAM and disk capacities are measured in bytes, or, more typically, in thousands of bytes (kilobytes or KB) or millions of bytes (megabytes or MB). Here's where people get a bit—pun only slightly intended—confused, because the abbreviations are only one capitalization apart: little b for bit, versus big B for byte.

Baud: This is the winner for most misused term. Baud is not the same as bits per second, although you'll hear nearly everyone use it that way. Technically, it's a measure of how fast a modem "signals"—how many data bursts a modem sends every second. Why isn't that the same as bits per second? Because every burst can contain several bits, so a 2400 baud modem can actually be sending data at 14,400 bits per second: Each signal just contains 6 bits. Don't press people too hard on this one—it'll make their heads explode. In fact, play it safe: Don't use this term. Use bits per second instead.

ADSL

Speed: 64 Kbps–4 Mbps
Cost: $500–$2000 for hardware, plus $50 for monthly fees
Availability: very bad, but expected to improve

ADSL stands for Asymmetric Digital Subscriber Line, an emerging technology that is getting a lot of press—and hype. When receiving data, ADSL is anywhere from 52 to 139 times faster than a 28.8 Kbps modem. ADSL is much slower when sending data, moving at 2 to 17 times the speed of a 28.8 Kbps modem.

How It Works

ADSL is the phone company's answer to cable modems. It provides ultra-fast data transfers, and is being pitted against cable modems as the solution to bust average consumers' bandwidth blues. Depending on the type of ADSL system used, the technology can transfer data downstream (to the user) at 1.5 to 4 Mbps, and upstream (from the user) at 64 to 500 Kbps. Because of its lopsided transmission rates, ADSL may be an excellent choice for those who need to receive a lot of data, but not send huge amounts. This means it wouldn't be practical to run a popular Web site over ADSL.

ADSL works over existing phone wires, and like ISDN, requires special consumer hardware, an ISP that can feed you data, and a special connection to the phone company. There are an estimated 560 million copper telephone wires installed around the globe, but traditional phone service uses only 1 percent of the bandwidth that these wires can hold. ADSL leverages the remaining 99 percent by using a different form of modulation to squeeze more information through the copper wires than is possible with standard voice calls and analog modems.

Caveats

ADSL has promise, and although you may be ready for it despite its high startup cost, ADSL is not ready for you. ADSL won't disappear into the vapor, but it will be a few more months, maybe a year, before it congeals into services and products that you can really use.

How to Get It

Here's the problem: Unless you're lucky enough to live in one of the few areas where phone companies are conducting ADSL trials, you and your community will have to wait your turn. The telcos backing ADSL say the technology will be available in some cities by the end of the year, or early 1997—optimistic projections for a solution that's still in its early testing stages. GTE (http://www.gte.com/) is conducting the industry's first ADSL trial in the Dallas/Fort Worth area. The company has also announced trial service in Redmond, WA, home of Microsoft. Pacific Bell has announced an ADSL trial in San Ramon, CA. Other phone companies are following: Bell Atlantic, BellSouth, SBC Communications, and US West have also announced ADSL trials. Metropolitan centers will be the first to enjoy these bold experiments.

How Much It Costs

Prices for ADSL routers will range from $500 to $2000 depending on speed and configuration. Installation of an ADSL line could also be a major hurdle, at an estimated $3000. All of this hardware is currently in short supply, so prices should drop dramatically in a few months as ADSL becomes more common.

The monthly service fee from your phone company will be low—likely a flat a fee less than $50. Costs incurred by ISPs will likely be much higher: Some ISPs have only a T1 (1.54 Mbps) bandwidth pipe to share among all their analog modem customers, so they'll need to invest big bucks to upgrade their capacity. Indeed, ISPs may stay out of ADSL altogether, leaving it up to the phone companies to provide Internet access in addition to the line itself. Once again, the lines between ISPs and telcos are blurring (see "How Your Data Snakes Across the Internet," September 1996).

Cable Modems

Speed: Up to 10 Mbps
Cost: around $300 for hardware, plus $30 for monthly fees
Availability: very bad, but expected to improve

If you have cable television, you're already downloading hundreds of thousands of megabits of data every second in the form of television signals. Wouldn't it be nice to harness some of that bandwidth to access the Internet? Cable modems can theoretically deliver Internet data at up to 350 times the speed of a 28.8 Kbps modem.

How It Works

In order to provide Internet access via the same high-bandwidth wires on which your television signals travel, your cable company allocates a portion of its cable signal (enough to carry a TV channel or two) to Internet data packets.

Packets traveling downstream from the Internet to your home are actually sent to all subscribers in your immediate area. Your cable modem, however, retrieves only packets intended for your unique address. This scenario differs from the cable TV model, in which TV signals can be retrieved and viewed by any subscriber who is tuned to a particular channel. Data packets traveling from your computer to the Internet follow a different model, which we describe under "Caveats"(below).

Cable modems can provide speeds of up to 10 Mbps for downstream access—that's the fastest bandwidth we've mentioned so far. Depending on the equipment you use, you'll be able to hook a cable modem to either a computer or a TV set, which would require Web surfing via a special remote control.

Caveats

Unlike ADSL, ISDN, and analog modem technology, cable Internet access is a shared resource: You don't get 10 Mbps to yourself. In fact, you share it with cable customers on several nearby blocks. If every cable customer logs onto the Internet at once—not likely—your access speed will slow to a crawl. And if you're the only one online—again, not likely—you get all the bandwidth to yourself. For most uses, 10 Mbps is more than enough to share with a few neighbors.

Sending data over cable isn't as easy as receiving it. Upstream data tends to attenuate as it travels to the cable company, getting lost under the stronger downstream television signals. Some companies believe they can deal with the problem by offering slower upstream access, as is the case with ADSL. Other companies will skirt the issue by offering a hybrid system: Incoming data will arrive via cable, but outgoing data will travel on your phone line via a traditional modem built into the cable box. For Web browsing and newsreading, this situation would work nicely, although it would tie up your phone while you're online. Finally, cable modems are currently vaporware.

How to Get It

If you're interested in this wonderful new technology, call your cable company, and say, "I want cable access to the Internet." Then hold your breath for a long, long time. Although some cable companies are further along than others, none are yet offering Internet access to everyone who can get HBO and MTV.

Cable Internet access is currently being spearheaded by two companies. Time Warner Cable (**http://www.twmaine.com/**) is test-marketing in Akron and Canton, OH, serving 300,000 customers at $39.95 a month.

@Home (**http://www.home.net/**), has been preparing to test-market in Fremont, CA, since the beginning of the year. If all goes well, Time Warner Cable will later open up shop in Portland, ME, Binghamton, NY, and San Diego, and @Home will move on to wire Sunnyvale, CA, Arlington Heights, IL, and Hartford, CT.

It's too early to offer specific tips on how to establish access, but rest assured, when cable modems come to your town, you'll be hearing about it.

How Much It Costs

Industry executives expect that cable modems will cost around $300. It's probable that when your cable company offers Internet access, it will rent the modem to you, or even loan it to you for free. The cost of Internet service is up to the cable company—expect no more than $40 a month for unlimited access. Since the cable company will provide the Internet feed, there will be no need for a separate ISP.

Predicting the Bandwidth Breakthrough

What technology will emerge as the leading bandwidth solution, and when can home consumers expect to reap its benefits? Five Internet opinion leaders make the call.

Avram Miller
Vice President of Business Development, Intel (http://www.intel.com)
"I don't think there will be a single solution. I think the two leading solutions will be cable modems and ADSL. My guess is that it will be evenly divided between the two. Twenty to 30 percent of the PC homes in the United States will have broadband capability by the end of the decade, by the combination of those two. I think satellite technology will play an important role in the U.S. but because of its late start, it won't play a dominant role."

Robert Metcalfe
Executive Correspondent, *Infoworld*, and Vice President of Technology, International Data Group
"The important thing about cable modems, ADSL, ISDN, etc., is not technological, but that competition be unleashed among them and other technologies, which means we have to demonopolize telecommunications. Allowing telcos to buy one another, and to buy cable companies, is not what we need, and should be stopped. ISDN is our best short-term solution beyond 28.8, and look how the telco monopolies have botched that for the last 20 years."

David Hakala
Editor, *Boardwatch*, a trade magazine for ISPs and Internet developers
"Cable, 18 months. Reason one: It's going to be the fastest solution of the ones currently proposed. Two: Cable companies very badly want a piece of the Internet action. Three: They're more competent than the RBOCs [regional phone companies]. ADSL still isn't anywhere, and 33.6 doesn't work over normal phone lines—you get a 16 percent increase about 10 percent of the time."

Mike O'Dell
Vice President and Chief Scientist, UUNET Technologies, Inc. (http://www.uu.net), one of the world's largest ISPs
"There probably won't be just one solution, assuming there are any. It's not at all clear that 'fast connections' will ever be 'cheap connections,' at least not in the way many folks are dreaming about. Does the phrase, 'Power too cheap to meter' ring a bell? How about 'Free, unlimited bandwidth'?"

Bill Gram-Reefer
MicroTimes columnist
"ISDN is DOA. Pac Bell's plan is to use cable modems where its fiber backbone is installed, and ADSL modems over copper in other areas until the fiber shows up. It will be mix-and-match to get the job done, although ADSL has an advantage until cable companies get more two-way cable installed."

Fractional T-1, T-1, and T-3

Speed: 56 Kbps-44.7 Mbps
Cost: around $1,000 for set-ups, plus at least $700 for monthly fees
Availability: good

If you're ready for a full-time connection that can send and receive data at a fast clip, you may opt for a fractional T-1, full T-1, or T-3 Internet connection. A full T-1 line offers 1.544 Mbps, more than 50 times the speed of a 28.8 Kbps modem. T-3 will give you a blistering 44.7 Mbps—28 times faster than a T-1. A fractional T-1 is a slice of a T-1 that can deliver from 56 Kbps to the top speed of 1.544 Mbps.

How It Works

T-1s and T-3s are very fast, dedicated circuits that move information between two points. They are useful for companies that need to have 24-hour, high-bandwidth Internet access for multiple employees. These lines require special equipment, including a costly Internet router.

Caveats

High-speed, dedicated access is expensive and complicated to set up and maintain, but it is a proven technology. If you need to run your own Internet server, this is the way to go.

How to Get It

Your phone company currently provides T-1 and T-3 service, and many ISPs provide dedicated Internet feeds. You will probably need an experienced consultant to help you sort out the hardware choices.

How Much It Costs

Once again, costs vary depending on your phone company, ISP, and bandwidth needs. A T-1 line from Pacific Bell costs about $1000 to set up, plus around $700 a month for service. T3 lines are generally the domain of ISPs—only ISPs really need them, and only ISPs can really afford them.